

Appln. No. 09/745,754
Amendment dated June 4, 2003
Reply to Office Action of January 24, 2003

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-6 (cancelled)

- Claim 7 (currently amended): ~~The invention according to claim 1A~~ filtering system for filtering working fluid from a machine comprising a filter having a filter media element for filtering said working fluid, said filter having a first inlet receiving working fluid from said machine, said filter having a first outlet returning working fluid to said machine, said filter
- 5 having a second inlet receiving a cleaning fluid from a source of cleaning fluid, said filter having a second outlet exhausting said cleaning fluid, said filter media element having a clean side communicating with said first outlet and said second inlet, said filter media element having a dirty side communicating with said first inlet and said second outlet, said filter having a first flowpath therethrough from said first inlet through said filter media
- 10 element in one direction to said first outlet, said filter having a second flowpath therethrough from said second inlet through said filter media element in the opposite direction to said second outlet, said first and second flowpaths having common but opposite direction portions through said filter media element, said filter having a filtering mode of operation with said second inlet closed and said second outlet closed and filtering fluid flow
- 15 therethrough along said first flowpath, said filter having a backwash mode of operation with said second inlet open and said second outlet open and said cleaning fluid flowing therethrough along said second flowpath and backwashing contaminant-laden working fluid from said dirty side of said filter media element to said second outlet, a contaminant separator having an inlet connected to said second outlet of said filter and receiving and
- 20 separating contaminant from said contaminant-laden working fluid, wherein said contaminant separator comprises a centrifuge having a rotor separating contaminant from working fluid, and a storage container storing said contaminant, wherein said rotor is driven to rotate by a motive force, and wherein said motive force and said cleaning fluid are each provided by pressurized fluid, namely pressurized drive fluid for said motive force, and

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- 25 pressurized backflushing fluid for said cleaning fluid, wherein backflushing pressure is applied by pressurized backflushing fluid from said second inlet, and wherein said motive force is applied by pressurized drive fluid externally of said rotor and externally of said storage container.

Claim 8 (original): The invention according to claim 7 wherein said rotor of said centrifuge is driven to rotate by a motive force, and wherein said motive force and said cleaning fluid are each provided by pressurized air.

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Claim 9 (original): The invention according to claim 8 wherein said source of cleaning fluid comprises a source of compressed air, and wherein the same said source of compressed air supplies both said motive force for said rotor and said cleaning fluid for said filter.

Claim 10 (original): The invention according to claim 7 wherein said storage container comprises a second filter media element reducing fluid turbulence particularly during rotor speed gradients at start-up and trapping contaminant particles and reducing particle re-entrainment during said rotor speed gradients.

Claim 11(original): The invention according to claim 10 wherein said second filter media element comprises a matrix of filter material of at least 75% void volume.

Claim 12 (original): The invention according to claim 11 wherein said void volume is at least 95%.

Claim 13 (original): The invention according to claim 7 wherein said centrifuge has a minimum capacity equal to the capacity of said stored contaminant plus the capacity of said filter.

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Claim 14 (original): The invention according to claim 13 wherein said rotor includes an annular chamber providing said storage container.

β1
5 Claim 15 (original): The invention according to claim 7 wherein said rotor of said centrifuge is driven to rotate by a motive force, said motive force and said cleaning fluid are each provided by pressurized air, said source of cleaning fluid comprises a source of compressed air, said source of compressed air supplies both said motive force for said
10 rotor and said cleaning fluid for said filter, and comprising a first valve controlling the supply of pressurized air from said source of compressed air to said second inlet of said filter, and a second valve controlling the supply of pressurized air from said source of compressed air to said rotor of said centrifuge, said first and second valves operating such that said rotor begins spinning prior to introduction of contaminant-laden working fluid to said inlet of said centrifuge such that the centrifugal force of the already spinning rotor creates a hollow central air core in said contaminant-laden working fluid allowing escape of air.

Claims 16 (currently amended): In a filtering system for filtering working fluid from a machine ~~where filter capacity is too low for a permanent filter yet flow rate is too high for a centrifuge~~, a combination ~~employing the flow rate capability of a filter with the storage capacity capability of a centrifuge~~, comprising a cleanable filter having a filter media
5 element for filtering said working fluid, said cleanable filter having a first inlet receiving working fluid from said machine, said cleanable filter having a first outlet returning working fluid to said machine, said cleanable filter having a second inlet receiving a cleaning fluid from a source of cleaning fluid, said cleanable filter having a second outlet exhausting said cleaning fluid, said filter media element having a clean side
10 communicating with said first outlet and said second inlet, said filter media element having a dirty side communicating with said first inlet and said second outlet, said cleanable filter having a first flowpath therethrough from said first inlet through said filter media element in one direction to said first outlet, said cleanable filter having a second

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15 flowpath therethrough from said second inlet through said filter media element in the
opposite direction to said second outlet, said first and second flowpaths having common
but opposite direction portions through said filter media element, said cleanable filter
having a filtering mode of operation with said second inlet closed and said second outlet
closed and filtering fluid flow therethrough along said first flowpath, said cleanable filter
20 having a backwash mode of operation with said second inlet open and said second outlet
open and cleaning fluid flowing therethrough along said second flowpath and
backwashing contaminant-laden working fluid from said dirty side of said filter media
element to said second outlet, a ~~said~~ centrifuge having an inlet connected to said second
outlet of said cleanable filter, said centrifuge having a batch processing mode operative
25 during said backwashing mode of said cleanable filter and receiving said contaminant-
laden working fluid from said second outlet of said cleanable filter and separating and
storing contaminant.

β1
Claim 17 (original): The invention according to claim 16 wherein said cleanable filter is a
continuous flow filter in said filtering mode, and said centrifuge is a non-continuous flow
batch processor having a rotor driven during said backwash mode of said cleanable filter
and separating contaminant, said rotor being nondriven during said filtering mode of said
5 cleanable filter

Claim 18 (original): The invention according to claim 16 comprising a plurality of said
cleanable filters having respective said second outlets connected in parallel to said inlet of
said centrifuge.

Claim 19 (original): The invention according to claim 18 wherein said centrifuge has a
plurality of batch processing modes operating serially sequentially, one mode for each of
said cleanable filters.

Claims 20-88 (canceled)

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Claim 89 (currently amended): ~~The invention according to claim 88~~ A filtering system for filtering working fluid from a machine, said system combining a cleanable filter and a centrifuge and transferring a contaminant storage function from said cleanable filter to said centrifuge, said cleanable filter having a filter media element for filtering said
5 working fluid, said cleanable filter having a first inlet receiving working fluid from said machine, said cleanable filter having a first outlet returning working fluid to said machine, said cleanable filter having a second inlet receiving a cleaning fluid from a source of cleaning fluid, said cleanable filter having a second outlet exhausting said cleaning fluid, said filter media element having a clean side communicating with said first
10 outlet and said second inlet, said filter media element having a dirty side communicating with said first inlet and said second outlet, said cleanable filter having a first flowpath therethrough from said first inlet through said filter media element in one direction to said first outlet, said cleanable filter having a second flowpath therethrough from said second
15 inlet through said filter media element in the opposite direction to said second outlet, said first and second flowpaths having common but opposite direction portions through said filter media element, said cleanable filter having a filtering mode of operation with said second inlet closed and said second outlet closed and filtering fluid flow therethrough along said first flowpath, said cleanable filter having a backwash mode of operation with
20 said second inlet open and said second outlet open and cleaning fluid flowing therethrough along said second flowpath and backwashing contaminant-laden working fluid from said dirty side of said filter media element to said second outlet, said centrifuge having an inlet connected to said second outlet of said cleanable filter and receiving contaminant-laden working fluid therefrom and separating and storing contaminant, said centrifuge comprising a housing having a rotor mounted for rotation therein about an axis,
25 said rotor having an inner cylindrical sidewall with a hollow interior, and an outer cylindrical sidewall spaced radially outwardly of said inner cylindrical sidewall and defining an annular space therebetween, said inner cylindrical sidewall having a transfer passage therethrough providing communication of said hollow interior with said annular

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30 space, said housing having an inlet for admitting contaminant-laden fluid to said hollow
interior of said inner cylindrical sidewall for passing through said transfer passage into
said annular space for centrifugal separation upon said rotation, said annular space
providing a storage container storing said contaminant, a standpipe circumscribing said
inner cylindrical sidewall and dividing said annular space into an inner annular chamber
35 between said standpipe and said inner cylindrical sidewall, and an outer annular chamber
between said standpipe and said outer cylindrical sidewall, wherein said rotor has a base
plate extending between said inner and outer cylindrical sidewalls, said rotor base plate
has a drain passage communicating with said annular space and effective upon stopping
of said rotation to drain fluid therefrom, said standpipe has an upper end at said transfer
passage, and has a lower end at said drain passage, and wherein said contaminant-laden
40 fluid comprises contaminant-laden liquid in a gas stream, and such that during rotation,
gas in said gas stream from said transfer passage is vented through said inner annular
chamber to said drain passage, and contaminant-laden liquid from said transfer passage is
centrifugally propelled into said outer annular chamber.

Claim 90 (original): The invention according to claim 89 comprising high-loft filter media
in said outer annular chamber comprising a matrix of filter material of at least 75% void
volume, said outer annular chamber providing a storage container storing said contaminant
and retaining said contaminant in said high-loft filter media, said high-loft filter media
5 retaining and storing said separated contaminant in said outer annular chamber, including
after said rotation when said rotor is stopped, said high-loft filter media reducing re-
entrainment of said separated contaminant during start-up at the beginning of the next
rotation of said rotor.

Claim 91 (original): The invention according to claim 89 wherein said rotor outer cylindrical
sidewall is removably separable from said base, and wherein said rotor further comprises a
disposable liner shell capsule extending along and lining the interior of said outer cylindrical
sidewall and accumulating and containing contaminant, such that said centrifuge may be

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- 5 serviced by removing said outer cylindrical sidewall and discarding said disposable liner shell capsule with contained contaminant therein and replacing same with another disposable liner shell capsule.

Claims 92-93 (canceled)

Claim 94 (new): The invention according to claim 7 wherein said backflushing fluid and said working fluid are different fluids.

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Claim 95 (new): The invention according to claim 94 wherein said drive fluid is the same as said backflushing fluid and different than said working fluid.

- Claim 96 (new): The invention according to claim 7 wherein said rotor has an inner cylindrical sidewall, and an outer cylindrical sidewall spaced radially outwardly of said inner cylindrical sidewall, and comprising an annular space between said inner and outer cylindrical sidewalls and providing said storage container, and comprising a turbine on
5 said outer cylindrical sidewall and external of said annular space for causing rotation of said rotor in response to impingement of said pressurized drive fluid against said turbine.

- Claim 97 (new): The invention according to claim 96 comprising high-loft filter media in said annular space, said high-loft filter media comprising a matrix of filter material of at least 75 % void volume, said matrix of filter material of said high-loft filter media being selected from the group consisting of fibrous material, polyester, foam including
5 reticulated foam, spun bonded web, wire mesh including stainless steel, and sintered material including porous composites, and wherein said rotor has a base plate extending between said inner and outer cylindrical sidewalls, said rotor base plate having a drain passage communicating with said annular space and effective upon stopping of rotation of said rotor to drain fluid therefrom, said rotor base plate having a configured surface
10 facing upwardly toward said annular space and having an upper-height outer portion

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adjacent said outer cylindrical sidewall, a lower pocket portion, and an intermediate-height inner portion adjacent said inner cylindrical sidewall, said configured surface being tapered radially inwardly and downwardly from said upper-height outer portion to said lower pocket portion and then upwardly to said intermediate-height inner portion, said
15 upper-height outer portion having a height higher than said intermediate-height inner portion, said intermediate-height inner portion having a height greater than said lower pocket portion, said drain passage being at said intermediate-height inner portion, such that separated contaminant not retained by said high-loft filter media is collected in said lower pocket portion, and fluid above said collected contaminant in said lower pocket
20 portion drains to said drain passage.

Claim 98 (new): The invention according to claim 89 wherein said standpipe has an upper reach at said upper end at a level vertically below said transfer passage.

Claim 99 (new): The invention according to claim 98 wherein said standpipe has one or more openings at said lower end draining fluid therethrough from said outer annular chamber to said drain passage upon said stopping of said rotation, wherein said rotor has a base plate extending between said inner and outer cylindrical sidewalls, said rotor base
5 plate has a configured surface facing said annular space and gravitationally guiding drainage of liquid therefrom to said drain passage upon said stopping of rotation, and wherein said standpipe at said lower end is mounted to said rotor base plate at said configured surface, and wherein said configured surface has an upper-height outer portion adjacent said outer cylindrical sidewall, a lower pocket portion, and an intermediate-
10 height inner portion adjacent said inner cylindrical sidewall, said configured surface being tapered radially inwardly and downwardly from said upper-height outer portion to said lower pocket portion and then upwardly to said intermediate-height inner portion, said upper-height outer portion having a height higher than said intermediate-height inner portion, said intermediate-height inner portion having a height higher than said lower
15 pocket portion, said drain passage being at said intermediate-height inner portion, such

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that separated contaminant is collected in said lower pocket portion, and liquid above said collected contaminant in said lower pocket portion drains to said drain passage.
